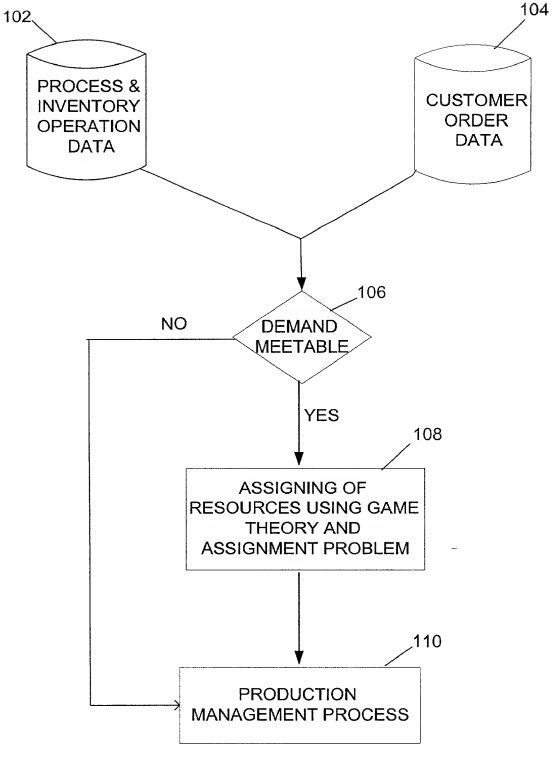
102
PROCESS & INVENTORY OPERATION DATA
104
CUSTOMER ORDER DATA
106
DEMAND MEETABLE
NO
YES
108
ASSIGNING OF RESOURCES USING GAME THEORY AND ASSIGNMENT PROBLEM
110
PRODUCTION MANAGEMENT PROCESS

FIG. 1

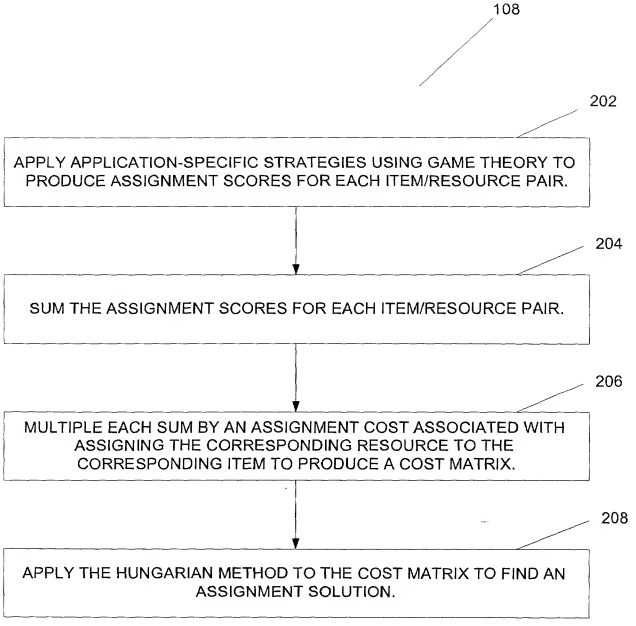
108
202
APPLY APPLICATION-SPECIFIC STRATEGIES USING GAME THEORY TO PRODUCE ASSIGNMENT SCORES FOR EACH ITEM/RESOURCE PAIR.
204
SUM THE ASSIGNMENT SCORES FOR EACH ITEM/RESOURCE PAIR.
206
MULTIPLE EACH SUM BY AN ASSIGNMENT COST ASSOCIATED WITH ASSIGNING THE CORRESPONDING RESOURCE TO THE CORRESPONDING ITEM TO PRODUCE A COST MATRIX.
208
APPLY THE HUNGARIAN METHOD TO THE COST MATRIX TO FIND AN ASSIGNMENT SOLUTION.

FIG. 2

300

| | RESOURCE1 | RESOURCE2 | ... | RESOURCEj | RESOURCE k |
|---|---|---|---|---|---|
| ITEM1 | $C_{11}$ | $C_{12}$ | | | |
| ITEM 2 | $C_{21}$ | $C_{22}$ | | | |
| . . . | | | | | |
| ITEM i | | | | $C_{ij}$ | |
| ITEM n | | | | | $C_{nk}$ |

FIG. 3

EL 507 470 660 US

400

| ITEM 1 | BUFFER 1 | BUFFER 2 | BUFFER 3 | BUFFER 4 | BUFFER 5 |
|---|---|---|---|---|---|
| STRATEGY 1 | 0.6 | 0.8 | 0.9 | 0.6 | 0.9 |
| STRATEGY 2 | 0.8 | 0.7 | 0.0 | 0.9 | 0.9 |
| STRATEGY 3 | 0.0 | 0.9 | 0.8 | 0.0 | 0.8 |
| STRATEGY 4 | 0.6 | 0.6 | 0.8 | 0.0 | 0.9 |
| TOTAL | 2 | 3 | 2.5 | 1.5 | 3.5 |

402

| ITEM 2 | BUFFER 1 | BUFFER 2 | BUFFER 3 | BUFFER 4 | BUFFER 5 |
|---|---|---|---|---|---|
| STRATEGY 1 | 0.8 | 0.6 | 0.95 | 0.75 | 0.35 |
| STRATEGY 2 | 0.1 | 0.9 | 0.85 | 0.65 | 0.65 |
| STRATEGY 3 | 0.7 | 0.85 | 0.95 | 0.45 | 0.15 |
| STRATEGY 4 | 0.9 | 0.65 | 0.95 | 0.95 | 0.95 |
| TOTAL | 2.5 | 3 | 3.7 | 2.8 | 2.1 |

EL 707 410 660 US

**FIG. 4**

500

| | BUFFER 1 | BUFFER 2 | BUFFER 3 | BUFFER 4 | BUFFER 5 |
|---|---|---|---|---|---|
| ITEM 1 | 2 | 3 | 2.5 | 1.5 | 3.5 |
| ITEM 2 | 2.5 | 3 | 3.7 | 2.8 | 2.1 |
| ITEM 3 | 2.8 | 3.8 | 3.1 | 2.1 | 2 |
| ITEM 4 | 2.3 | 3.4 | 3.1 | 3.9 | 1.6 |
| ITEM 5 | 3.8 | 2.1 | 1.0 | 2.5 | 2.3 |

502

| | BUFFER 1 | BUFFER 2 | BUFFER 3 | BUFFER 4 | BUFFER 5 |
|---|---|---|---|---|---|
| ITEM 1 | 1.5 | 2.66 | 0.784 | 6.60 | 0.857 |
| ITEM 2 | 3.2 | 2.33 | 0.54 | 3.21 | 3.33 |
| ITEM 3 | 2.14 | 1.05 | 0.645 | 3.3 | 2.50 |
| ITEM 4 | 3.47 | 1.17 | 0.645 | 0.769 | 3.125 |
| ITEM 5 | 2.368 | 4.76 | 6.0 | 3.6 | 4.34 |

502

| | BUFFER 1 | BUFFER 2 | BUFFER 3 | BUFFER 4 | BUFFER 5 |
|---|---|---|---|---|---|
| ITEM 1 | 3 | 8 | 2 | 10 | 3 |
| ITEM 2 | 8 | 7 | 2 | 9 | 7 |
| ITEM 3 | 6 | 4 | 2 | 7 | 5 |
| ITEM 4 | 8 | 4 | 2 | 3 | 5 |
| ITEM 5 | 9 | 10 | 6 | 9 | 10 |

**FIG. 5**

602

IDENTIFY THE MINIMUM VALUE IN EACH ROW OF THE ORIGINAL N X N COST MATRIX.

604

FOR EACH MINIMUM VALUE IDENTIFIED, SUBTRACT THE MINIMUM VALUE FROM EACH ENTRY IN THE CORRESPONDING ROW.

606

IN THE MATRIX RESULTING FROM STEP 604, IDENTIFY THE MINIMUM VALUE IN EACH COLUMN.

608

FOR EACH MINIMUM VALUE IDENTIFIED IN STEP 606, SUBTRACT THE MINIMUM VALUE FROM EACH ENTRY IN THE CORRESPONDING COLUMN OF THE MATRIX RESULTING FROM STEP 604.

610

IN THE MATRIX RESULTING FROM THE PREVIOUS STEP, DRAW THE MINIMUM NUMBER OF LINES THROUGH THE ROWS AND COLUMNS NEEDED TO COVER ALL ZEROES.

612

IF THE MINIMUM NUMBER OF LINES DRAWN IN 610 IS LESS THAN OR EQUAL TO N THEN FEASIBLE SOLUTION/SOLUTIONS EXIST AND IF EACH RESOURCE IS ALLOCATED TO A BUFFER THEN THAT IS OPTIMAL. MULTIPLE OPTIMAL SOLUTION EXIST IF THE BUFFER AND RESOURCE ALLOCATION CAN BE MADE WITHOUT THE TOTAL COST FUNCTION BEING AFFECTED. IF THERE EXIST NO FEASIBLE SOLUTION (MINIMUM NUMBER OF LINES DRAWN IN 610 IS GREATER THAN N) THEN PROCEED TO STEP 614.

614

SELECT THE SMALLEST UNCOVERED ELEMENT, AND SUBTRACT IT FROM EVERY UNCOVERED ELEMENT; THEN ADD THE SMALLEST UNCOVERED ELEMENT TO EVERY ELEMENT AT THE INTERSECTION OF TWO LINES. PROCEED TO STEP 610.

FIG. 6

702

| | BUFFER 1 | BUFFER 2 | BUFFER 3 | BUFFER 4 | BUFFER 5 | ROW MINIMUM |
|---|---|---|---|---|---|---|
| ITEM 1 | 3 | 8 | 2 | 10 | 3 | 2 |
| ITEM 2 | 8 | 7 | 2 | 9 | 7 | 2 |
| ITEM 3 | 6 | 4 | 2 | 7 | 5 | 2 |
| ITEM 4 | 8 | 4 | 2 | 3 | 5 | 2 |
| ITEM 5 | 9 | 10 | 6 | 9 | 10 | 6 |

704

| | BUFFER 1 | BUFFER 2 | BUFFER 3 | BUFFER 4 | BUFFER 5 |
|---|---|---|---|---|---|
| ITEM 1 | 3-2=1 | 8-2=6 | 2-2=0 | 10-2=8 | 3-2=1 |
| ITEM 2 | 6 | 5 | 0 | 7 | 5 |
| ITEM 3 | 4 | 2 | 0 | 5 | 3 |
| ITEM 4 | 6 | 2 | 0 | 1 | 3 |
| ITEM 5 | 3 | 4 | 0 | 3 | 4 |
| COLUMN MINIMUM | 1 | 2 | 0 | 1 | 1 |

706

| | BUFFER 1 | BUFFER 2 | BUFFER 3 | BUFFER 4 | BUFFER 5 |
|---|---|---|---|---|---|
| ITEM 1 | 0 | 4 | 0 | 7 | 0 |
| ITEM 2 | 5 | 3 | 0 | 6 | 4 |
| ITEM 3 | 3 | 0 | 0 | 4 | 2 |
| ITEM 4 | 5 | 0 | 0 | 0 | 2 |
| ITEM 5 | 2 | 2 | 0 | 2 | 3 |

FIG. 7A

708

| | BUFFER 1 | BUFFER 2 | BUFFER 3 | BUFFER 4 | BUFFER 5 |
|---|---|---|---|---|---|
| ITEM 1 | 0 | 4 | 0+2=2 | 7 | 0 |
| ITEM 2 | 5-2=3 | 3-2=1 | 0 | 6-2=4 | 4-2=2 |
| ITEM 3 | 3 | 0 | 0+2=2 | 4 | 2 |
| ITEM 4 | 5 | 0 | 0+2=2 | 0 | 2 |
| ITEM 5 | 2-2=0 | 2-2=0 | 0 | 2-2=0 | 3-2=1 |

710

| | BUFFER 1 | BUFFER 2 | BUFFER 3 | BUFFER 4 | BUFFER 5 |
|---|---|---|---|---|---|
| ITEM 1 | 0 | 4 | 2 | 7 | 0 |
| ITEM 2 | 3 | 1 | 0 | 4 | 2 |
| ITEM 3 | 3 | 0 | 2 | 4 | 2 |
| ITEM 4 | 5 | 0 | 2 | 0 | 2 |
| ITEM 5 | 0 | 0 | 0 | 0 | 1 |

FIG. 7B

| ITEMS | BUFFERS | COST (UNITS) |
|---|---|---|
| ITEM 1 | BUFFER 5 | 3 |
| ITEM 2 | BUFFER 3 | 2 |
| ITEM 3 | BUFFER 2 | 4 |
| ITEM 4 | BUFFER 4 | 3 |
| ITEM 5 | BUFFER 1 | 9 |
| TOTAL COST INVOLVED | | 21 |

**FIG. 8**

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